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(54) **AIR-CONDITIONING APPARATUS**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

4,381,651 A * 5/1983 Kubo F25B 41/06 62/296
5,875,651 A * 3/1999 Hill F25B 41/06 138/44
(Continued)

FOREIGN PATENT DOCUMENTS

CN 201886685 U * 6/2011
IT EP 0722667 A1 * 7/1996 ..... A23G 9/04
(Continued)

OTHER PUBLICATIONS

International Search Report of the International Searching Authority mailed Sep. 13, 2011 for the corresponding international application No. PCT/JP2011/003387 (and English translation).
(Continued)

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(57) **ABSTRACT**

An air-conditioning apparatus is capable of suppressing refrigerant flow noise regardless the refrigerant state of an inlet of an expansion mechanism. In parallel to a flow control valve, an opening and closing valve that opens and closes a refrigerant passage and an expansion mechanism having porous bodies capable of passing a refrigerant therethrough are connected in series with each other. In a heating mode, in the case where a controller stops an operation of one or more of a plurality of indoor units and causes the other indoor unit(s) to operate, the flow control valve of the stopped indoor unit is fully closed and the opening and closing valve of the stopped indoor unit is opened.

12 Claims, 4 Drawing Sheets